Anomalous coronary sinus ostium on cardiac computed tomography

To the editor We read with great interest the recent paper by Młynarski et al,[1] published in *Kardiologia Polska* (*Kardiol Pol*, *Polish Heart Journal*). The authors reported that cardiac computed tomography (CCT) with retrospective electrocardiographic (ECG) gating could detect the Vieussens valve in 141 of 325 patients (43.38%). Cardiac computed tomography requires the synchronization of the CT image with ECG using either prospective or retrospective ECG gating. In both methods, the ECG waveform is used to coordinate the image reconstruction with the position of the heart in the chest. Prospective ECG gating provides a static image of the restricted cardiac phase for morphological assessment of cardiac structure. In contrast, retrospective ECG gating enables us to evaluate the cardiac structure in a dynamic fashion during the entire cardiac cycle and to perform functional assessment in addition to morphological evaluation. The authors' previous report[2] demonstrated relevant findings showing that the cardiac venous systems are optimally visualized in the end-systolic phase (40% of the RR interval) on CCT, unlike the coronary arteries, which are usually optimally visualized in the mid-diastolic phase (70% to 80% of the RR interval). The most notable point in the authors' recent study[1] is that they identified the Vieussens valve using indirect analyses. Specifically, they analyzed changes in coronary sinus (CS) contrast-agent opacity during the cardiac cycle, based on the fact that even a very thin valve is an obstacle to the flow of the contrast medium in the same way as the much larger valves visualized on CT. In our opinion, their attempt is very intriguing, because the direct visualization of the Vieussens valve in the static CCT image is usually difficult, despite the fact that its recognition in vivo is quite important, particularly in the field of electrophysiology.[3]

In patients undergoing electrophysiology studies, catheter ablation for arrhythmias, and resynchronization therapy device implantation, it is common to use the CS as a gateway to the left atrial and left ventricular epicardium. It has been reported that catheterization of the CS and cardiac veins is unsuccessful in 10% to 20% of patients undergoing invasive cardiac procedures. It is assumed that the procedure of cannulation of the CS and cardiac veins is limited by anatomical variations, irregularities, anomalies, and malformations.[4] We would like to share with our colleagues our observations with respect to CS anomalies.

A 69-year-old man with atrial tachyarrhythmia, scheduled for electrophysiology studies, was referred for CCT. The examination showed CS atresia of the right atrial ostium in the crux cordis area with 2 aberrant veins (FIGURE 1A). First, there was a vessel of 4 to 5 mm in diameter that coursed in the right atrioventricular groove along the right coronary artery and terminated into the right side of the right atrium (RA) (FIGURE 1A–1C). Second, there was a tortuous vessel of 2 to 3 mm in diameter that ascended along the atrial septum and terminated into the RA under the aortic annulus (FIGURE 1A–1C). Neither a persistent left superior vena cava nor an unroofed CS defect were found. The CS is a venous conduit between the coronary veins and the RA, with tributary veins draining both ventricles and atria. It lies posteriorly in the atrioventricular groove and empties into the RA via an atrial orifice in the crux cordis area. Anomalies of the CS are rare, and most cases are diagnosed incidentally at autopsy, surgery, or failure of cannula insertion from the RA into the CS. In this case, an aberrant vein was found, which coursed in the right atrioventricular groove, terminating into the right side of the RA. A previous report of invasive coronary angiography suggested that such a vein was a dilated small cardiac vein.[5] However, according to a review article on the anatomy of cardiac venous drainage, it may be a peculiarity in which the long venous tunnel of the RA is replaced or anastomosed with the small cardiac vein.[4] Cardiac computed

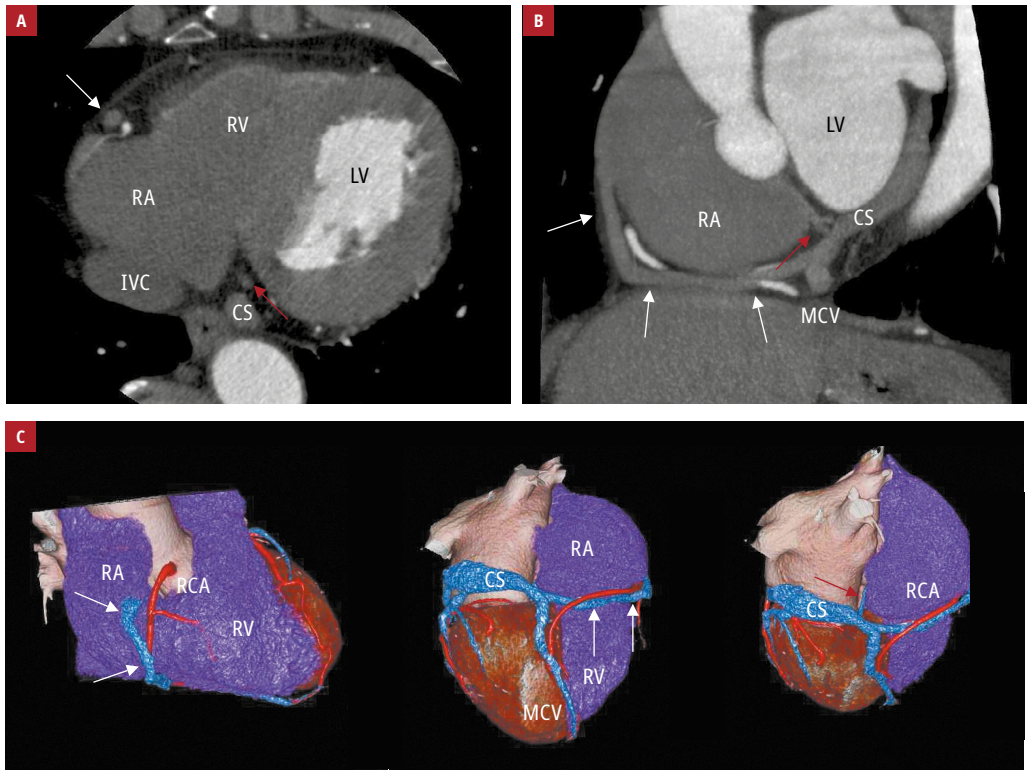

FIGURE 1 **A** – an axial, multiplanar reconstruction cardiac computed tomography image showing coronary sinus atresia of the right atrial ostium in the crux cordis area. The white arrow indicates an anomalous vessel arising from the coronary sinus, which coursed in the right atrioventricular groove along the right coronary artery. The red arrow indicates another anomalous vessel arising from the coronary sinus, which ascended along the atrial septum. **B** – a short-axis, multiplanar reconstruction cardiac computed tomography image showing atresia of the coronary sinus ostium in the crux cordis area with 2 aberrant veins. The white arrows indicate an anomalous vessel arising from the coronary sinus, which coursed in the right atrioventricular groove and terminated into the right side of the right atrium. The red arrow indicates another anomalous vessel arising from the coronary sinus, which ascended along the atrial septum and terminated into the right atrium under the aortic annulus. **C** – 3-dimensional, volume-rendered reconstruction cardiac computed tomography images showing atresia of the coronary sinus ostium in the crux cordis area with 2 aberrant veins (left: right anterior oblique view; middle: caudal view; right: right posterior oblique view). The white arrows indicate an anomalous vessel arising from the coronary sinus, which coursed in the right atrioventricular groove along the right coronary artery and terminated into the right side of the right atrium. The red arrow indicates another anomalous vessel arising from the coronary sinus, which ascended along the atrial septum and terminated into the right atrium under the aortic annulus. Abbreviations: CS, coronary sinus; IVC, inferior vena cava; LA, left atrium; LV, left ventricle; MCV, middle cardiac vein; RA, right atrium; RCA, right coronary artery; RV, right ventricle

tomography provides reliable, noninvasively obtained data on the cardiac venous anatomy, which are available before electrophysiological and interventional procedures are performed.

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Authors' reply Thank you very much for the comment on our paper from Dr Shu Yoshihara and colleagues.[1] We are grateful for

the kind words. Additionally, in their comment, the Japanese authors presented a case of a 69-year-old man with atrial tachyarrhythmia, who was scheduled for electrophysiology tests and referred for coronary computed tomography.[2] The patient was diagnosed with a rare anomaly of the coronary sinus in the form of an abnormal vein running in the right atrioventricular groove and ending on the right side of the right atrium. In this issue of *Kardiologia Polska* (*Kardiol Pol*, *Polish Heart Journal*), the authors also describe an enlarged coronary sinus with atresia of the atrial orifice that communicated with the persistent left superior vena cava.[3] Some authors, including us, believe that knowledge on the anatomy of the coronary sinus, including the ostium and its variants, will lead to new findings, which may be useful in selected cases before electrophysiology procedures.[4] All atypical cases confirm the logical approach of performing cardiac computed tomography in selected patients before elective electrophysiology procedures. Many of these cases with coronary sinus anomalies could serve as the basis for explaining any cannulation problems that occur during electrophysiology procedures.

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